

Walnutdale Dairy Farm Storm Water Control & Storage Structures

ALLEGAN COUNTY, DORR TOWNSHIP
SECTION 13, T4N - R12W



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TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, JUDGMENT AND BELIEF, THESE CONSTRUCTION DRAWINGS AND SPECIFICATIONS MEET ALL REQUIREMENTS AND SPECIFICATIONS.

ENGINEER
No. 36752
Marc Groenleer, P.E.
Date 8-30-04

TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, JUDGMENT, AND BELIEF, THESE PRACTICES ARE INSTALLED IN ACCORDANCE WITH THE CONSTRUCTION DRAWINGS AND SPECIFICATIONS.

Marc Groenleer, P.E.

Date

THESE CONSTRUCTION DESIGN PLANS AND SPECIFICATION HAVE BEEN REVIEWED AND ALL PARTIES UNDERSTAND THEIR RESPONSIBILITIES.

LANDOWNER/OPERATOR: _____

EXCAVATOR/CONTRACTOR: _____

CONSULTING ENGINEER: Marc E. Groenleer, P.E.



NTH Consultants, Ltd.
Infrastructure Engineering and Environmental Services
Farmington Hills, Detroit, Exton, Grand Rapids, Lansing

PROJECT NO. 13-020864
SCALE AS SHOWN
DRAWN BY PCW
CHECKED BY MEG

Walnutdale Dairy Farm
COVER SHEET
Storm Water Control & Storage Structures

DATE: AUG 2004
SHEET:

SHEET:

Walnutdale Dairy Farm

Storm Water Control & Storage Structures

ALLEGAN COUNTY, DORR TOWNSHIP
SECTION 13, T4N – R12W

SPECIFICATIONS

SPEC NO	TITLE
MI-102	DIVERSIONS
MI-108	GRASSED WATERWAYS
MI-118	SURFACE DRAINAGE DITCH
MI-150	SITE PREPARATION
MI-152	EXCAVATION
MI-154	EARTHFILL
MI-159	PLAIN CONCRETE
MI-162	SALVAGING AND SPREADING TOPSOIL
MI-164	LOOSE ROCK RIP RAP
MI-165	GEOTEXTILES
MI-166	SEEDING / MULCHING
MI-167	MULCH NETTING
MI-182	PLASTIC (PVC, PE) PIPE
MI-184	FLEXIBLE MEMBRANE LINERS

TABLE OF ESTIMATED QUANTITIES

ITEM	UNIT	QUANTITY
EARTHFILL	C.Y.	13,000
CUT	C.Y.	4,500
J-DRAIN	L.F.	1,200
EDPM 45-MIL LINER	S.F.	131,000
GEOWEB (8.5 FT x 29 FT)	SECT	6
GEOTEXTILE (NONWOVEN)	S.F.	4,100
CONCRETE	C.Y.	125
PVC GAS VENTS	EA.	3
SILT FENCE	L.F.	1,600
PIPE 12-INCH PVC	L.F.	120 (1X90, 1X30)
RIP RAP D ₅₀ – 6 INCH	C.Y.	24
MULCH AND SEED	ACRE	2.2
BLANKET MULCH AND SEED	S.Y.	6,500

BENCHMARK DESCRIPTION

THE BENCH MARK IS A SPIKE ON A UTILITY POLE THAT IS LOCATED NEAR THE NORTHWEST CORNER OF PIT 6 AS SHOWN ON SHEET 4. ELEVATION IS 764.36 FEET.



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Infrastructure Engineering and Environmental Services
Farmington Hills, Detroit, Exton, Grand Rapids, Lansing

PROJECT NO:
13-020004

SCALE:

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PCW

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MEG

Walnutdale Dairy Farm
BENCHMARK / QUANTITIES / SPECS
Storm Water Control & Storage Structures

DATE:
AUG 2004

SHEET:

SHEET:

2

GENERAL NOTES

1. THE OWNER IS RESPONSIBLE FOR OBTAINING AND COMPLYING WITH ALL PERMITS AND EASEMENTS. THIS INCLUDES ALL FEDERAL, STATE, AND LOCAL PERMITS.
2. THE OWNER IS RESPONSIBLE FOR INVESTIGATING AND COMPLYING WITH ALL LOCAL ORDINANCES, WHICH MAY PERTAIN TO THIS PERMIT.
3. MISS DIG (1-800-482-7171) MUST BE CONTACTED AT LEAST 3 DAYS PRIOR TO CONSTRUCTION INITIATION IF:
 - a) THE CONSTRUCTION EQUIPMENT WILL NOT BE ABLE TO MAINTAIN AT LEAST 10 FEET OF CLEARANCE FROM ANY OVERHEAD UTILITY LINES, OR
 - b) THE CONSTRUCTION ACTIVITIES INVOLVE ANY EXCAVATION, DRILLING OR BORING OPERATIONS, AND/OR DISCHARGE OF EXPLOSIVES IN OR ADJACENT TO A STREET, HIGHWAY, OR OTHER PUBLIC PLACE, IN A PRIVATE EASEMENT FOR A PUBLIC UTILITY, OR NEAR THE LOCATION OF UTILITY FACILITIES.
4. FOR SITES WHERE MISS DIG MUST BE CONTACTED, THE OWNER IS RESPONSIBLE FOR THE CONTRACTOR CONTACTING MISS DIG. THE MISS DIG TICKET NUMBER MUST BE AVAILABLE UPON REQUEST.
5. THE OWNER IS RESPONSIBLE FOR LOCATING ANY BURIED UTILITIES (WATERLINES, ELECTRIC LINES, TELEPHONE LINES, GAS LINES, SEWER LINES, ETC.) NOT COVERED BY THE MISS DIG PROGRAM.
6. THE CONSULTING ENGINEER MAKES NO CLAIM AND ASSUMES NO RESPONSIBILITY REGARDING THE PRESENCE OR NONEXISTENCE OF UTILITIES.
7. FOR SITES WHERE MISS DIG MUST BE CONTACTED, IT IS THE OWNER'S RESPONSIBILITY TO INFORM THE CONTRACTOR/EXCAVATOR OF THEIR RESPONSIBILITIES BY PROVIDING A COPY OF THE COVER SHEET. THE COVER SHEET MUST BE SIGNED BY THE CONTRACTOR AND BY DOING SO THEY ACKNOWLEDGE THAT THEY UNDERSTAND THEIR RESPONSIBILITIES. A COPY OF THE SIGNED COVERSHEET SHALL BE KEPT ON SITE DURING CONSTRUCTION AND COPIES SHALL BE DISTRIBUTED TO ASSOCIATED PARTIES.
8. THE CONTRACTOR IS RESPONSIBLE FOR KNOWING AND ACKNOWLEDGING THE APPROPRIATE SAFETY STANDARDS REQUIRED BY THE MICHIGAN OCCUPATIONAL SAFETY AND HEALTH ACT (MIOSHA).
9. ALL NECESSARY SAFETY EQUIPMENT MUST BE WORN BY THOSE EXPOSED TO WORK PLACE HAZARDS.
10. THE OWNER SHALL NOTIFY THE ENGINEER AT LEAST ONE-WEEK PRIOR TO INITIATION OF CONSTRUCTION. CALL 616-575-1012.
11. ANY DEVIATION FROM THESE PLANS AND SPECIFICATIONS WITHOUT THE APPROVAL OF THE CONSULTING ENGINEER COULD RESULT IN NONCOMPLIANCE WITH GUIDELINES AND/OR STORAGE STRUCTURE FAILURE.

DESIGN NOTES

1. THE WASTE WATER STORAGE STRUCTURE HAS BEEN DESIGNED IN ACCORDANCE WITH THE USDA-NRCS-MICH TECHNICAL GUIDE SECTION IV "STATE-WIDE WASTE STORAGE FACILITY 313."
2. THE FREEBOARD OF 2 FEET BELOW THE ELEVATION OF 759.5 FEET, ALLOWS FOR THE CONTAINMENT OF RUNOFF GENERATED FROM A 25-YEAR, 24 HOUR STORM PLUS THE NRCS SPECIFIED STANDARD OF 1 FOOT.
3. THIS STORAGE STRUCTURE HAS THE CAPACITY TO STORE 449,000 C.F. (3.36 MILLION GALLONS) INCLUDING 2 FEET OF FREEBOARD.
4. ALL RUNOFF FLOW INTO THE STORAGE STRUCTURE IS GRAVITY.
5. THE STRUCTURE HAS BEEN DESIGNED ASSUMING THAT THE FINAL FINISH GRADE OF THE BOTTOM WILL SLOPE TO THE NORTHWEST CORNER OF THE STORAGE STRUCTURE.
6. WARNING SIGNS, LADDERS, ROPES, BARS, RAILS, FENCES, AND/OR DEVICES SHALL BE PROVIDED, AS APPROPRIATE, IN AN ATTEMPT TO PRESERVE THE SAFETY OF HUMANS AND LIVESTOCK.
7. THE CONVEYANCE CHANNEL IS ON A 0.5% SLOPE. THE CHANNEL SHAPE IS TRIANGULAR. THE CHANNEL WALLS ARE TWO FEET IN HEIGHT OR GREATER WITH A 4:1 (HORIZONTAL TO VERTICAL) SIDE SLOPE OR SHALLOWER.
8. FOR THE PURPOSES OF THIS WORK IT HAS BEEN ASSUMED THAT SOLID ACCUMULATION BEYOND THE SOLIDS TRAP WILL BE MINIMAL AND WILL NOT SIGNIFICANTLY REDUCE THE VOLUME.
9. THE ENGINEER RECOMMENDS THAT THE ABOVE ASSUMPTIONS BE RECOGNIZED SO THAT DESIGN INTENT REMAINS VALID DURING CONSTRUCTION.

SPECIFICATION NOTES

1. THE OWNER SHALL ARRANGE A MEETING WITH THE CONTRACTOR AND THE ENGINEER TO REVIEW THE PLANS, STANDARDS, SPECIFICATIONS, AND TESTING REQUIREMENTS PRIOR TO CONSTRUCTION. OTHERWISE, THE ENGINEER CANNOT AND WILL NOT ACCEPT RESPONSIBILITY FOR DESIGN MISINTERPRETATIONS.
2. COMPACTED EARTH BERMS SHALL HAVE A SIDE SLOPE OF 3:1 OR FLATTER.
3. TO THE EXTENT TO WHICH THEY ARE NEEDED, ALL SUITABLE EXCAVATED MATERIALS WILL BE USED AS BERM MATERIAL. ALL EXCESS EXCAVATED MATERIAL WILL BE PLACED ON THE EXTERIOR SLOPES OF THE BERMS.
4. THE MATERIAL PLACED AS FILL SHALL BE FREE OF ALL SOD, ROOTS, FROZEN SOIL, AND/OR OTHER OBJECTIONABLE MATERIALS.
5. SOIL PLACED FOR THE BERMS SHALL BE PLACED WITH A COMPACTION OF 90% OF THE MAXIMUM DENSITY AS DETERMINED BY THE STANDARD PROCTOR TEST (ASTM D-698) OR COMPACTION SHALL FOLLOW THE METHODS DESCRIBED IN CONSTRUCTION SPECIFICATION MI-154, EARTH FILL. THE FILL PLACED FOR BERMS SHALL BE OBSERVED AND IN PLACE COMPACTION TESTED AT LEAST ONE DURING AND ONCE FOLLOWING CONSTRUCTION BY A QUALIFIED CIVIL ENGINEERING TECHNICIAN.
6. EXCAVATED FINAL GRADES AND INTERIOR SLOPES OF BERMS SHALL BE SMOOTH ROLLED PRIOR TO PLACEMENT OF THE EDPM LINER TO THE SATISFACTION OF THE LINER INSTALLER.
7. SPECIFICATION FOR THE LINER INSTALLATION SHALL BE PER MANUFACTURE'S RECOMMENDATIONS.
8. THE LINER OF THE SOLIDS TRAP SHALL BE UNDERLAIN BY J-DRAIN WITH APPROXIMATE SPACING OF 25 FEET ON CENTER OR AN ENGINEER APPROVED EQUIVALENT.
9. DURING AND/OR IMMEDIATELY FOLLOWING CONSTRUCTION ALL EMBANKMENTS AND DISTURBED AREAS SURROUNDING THE FACILITY SHALL BE TREATED TO CONTROL EROSION IN ACCORDANCE WITH THE STORMWATER CONTROL STRUCTURES SOIL EROSION CONTROL PLAN. THE MULCHING TYPE AND RATE AND SEEDING TYPE, RATE, AND METHOD ARE LEFT TO THE DISCRETION OF THE OWNER. SEE MI-166 FOR FURTHER DETAILS.
10. THE GEOWEB SHALL BE UNDERLAIN BY AN 8 OUNCE AMOCO 4553 NONWOVEN GEOTEXTILE.
11. ALL DISTURBED AREAS NOT ACTIVELY BEING WORKED FOR MORE THAN FIVE CONSECUTIVE DAYS MUST HAVE TEMPORARY GROUND COVER APPLIED.
12. PERMANENT EROSION CONTROL MUST BE APPLIED WITHIN FIVE DAYS OF FINAL GRADE.



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Infrastructure Engineering and Environmental Services
Farmington Hills, Detroit, Exton, Grand Rapids, Lansing

PROJECT NO:
13-020064
SCALE:
DRAWN BY:
CHECKED BY:
MEG

Walnutdale Dairy Farm
NOTES
Storm Water Control & Storage
Structures

DATE:
AUG 2004

SHEET:
3

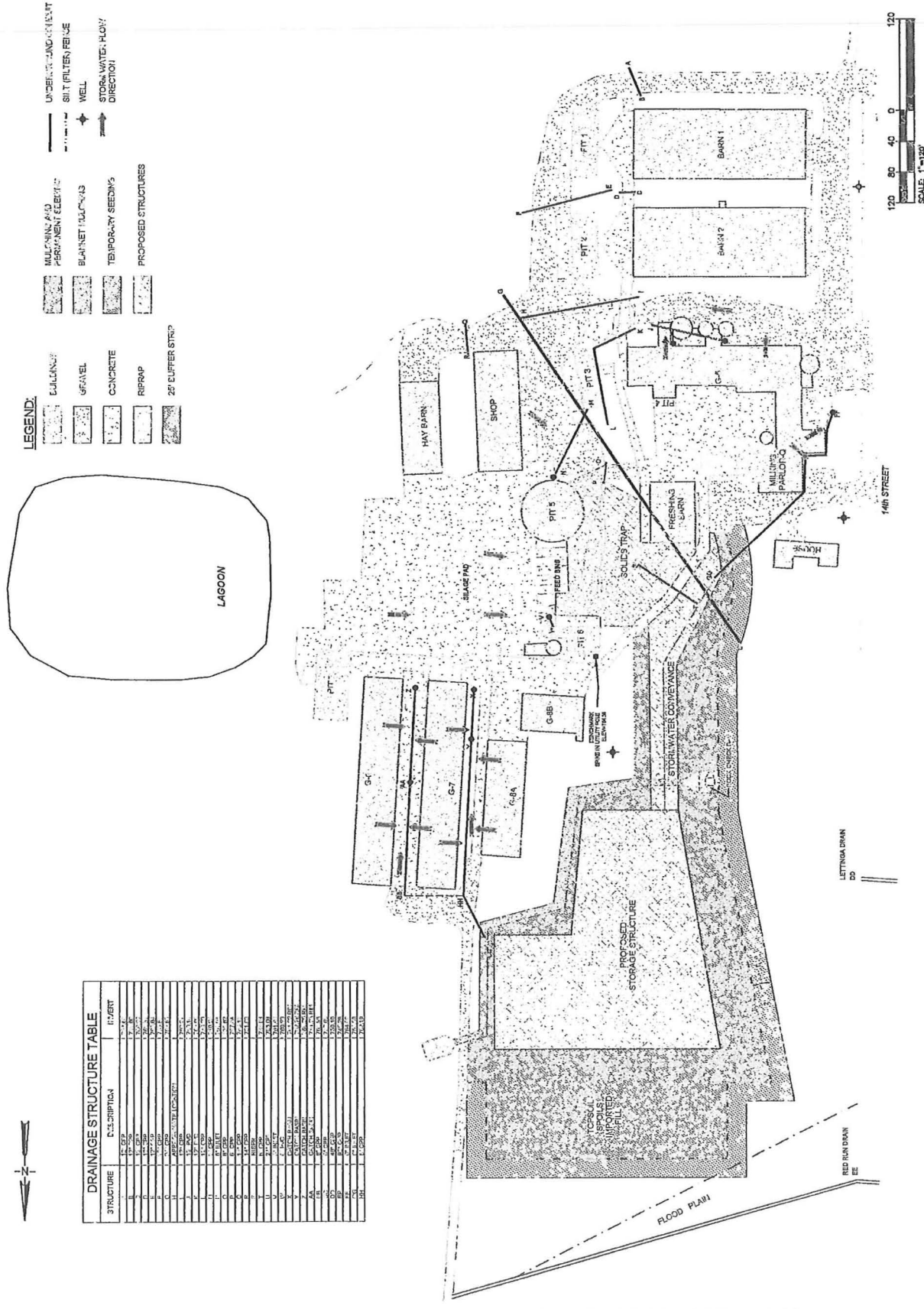
WALNUTDALE DAIRY FARM
OVERALL PLAN VIEW

WAYLAND TOWNSHIP
ALLEGAN COUNTY, MICHIGAN

FIGURE 4

NTM PROJECT No: 13-020064
DESIGNED BY: P.C.W.
DRAWN BY: J.M.R.
CHECKED BY: AS SHOWN
INCEPTION DATE: 8-9-04
DRAWING SCALE: 8-17-04
CADD FILE NAME: 020064004

NTM Consultants, Ltd.
Infrastructure Engineering
and Environmental Services



LEGEND:

● CULVERT

■ GRAVEL

■ CONCRETE

■ REPAIR

■ 20' BUFFER STRIP

■ MULTIPLE AND PERMANENT ELEVATION

■ BLANKET TULLING

■ TEMPORARY SEEDING

■ PROPOSED STRUCTURES

— UNDERDRAINAGE

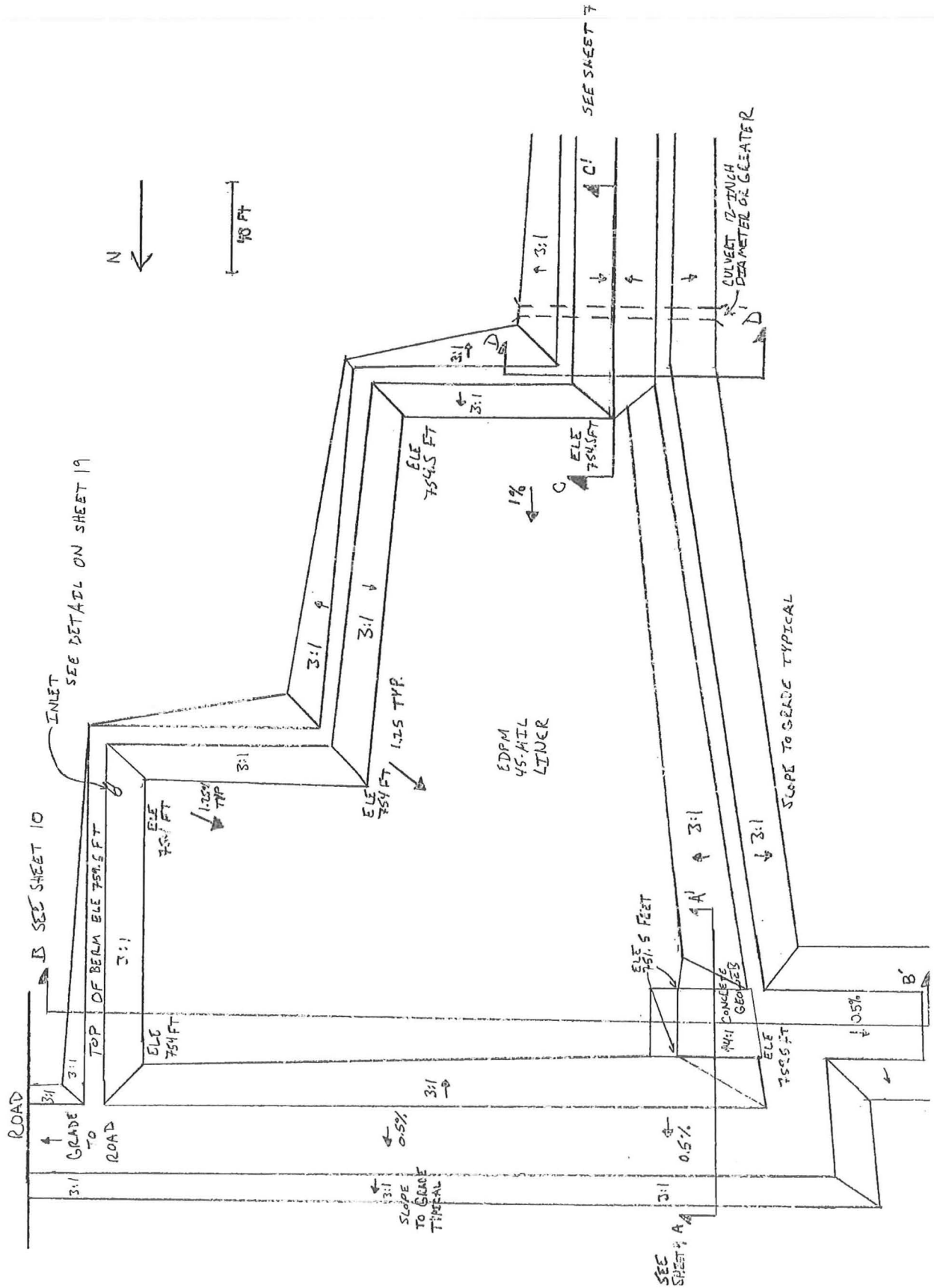
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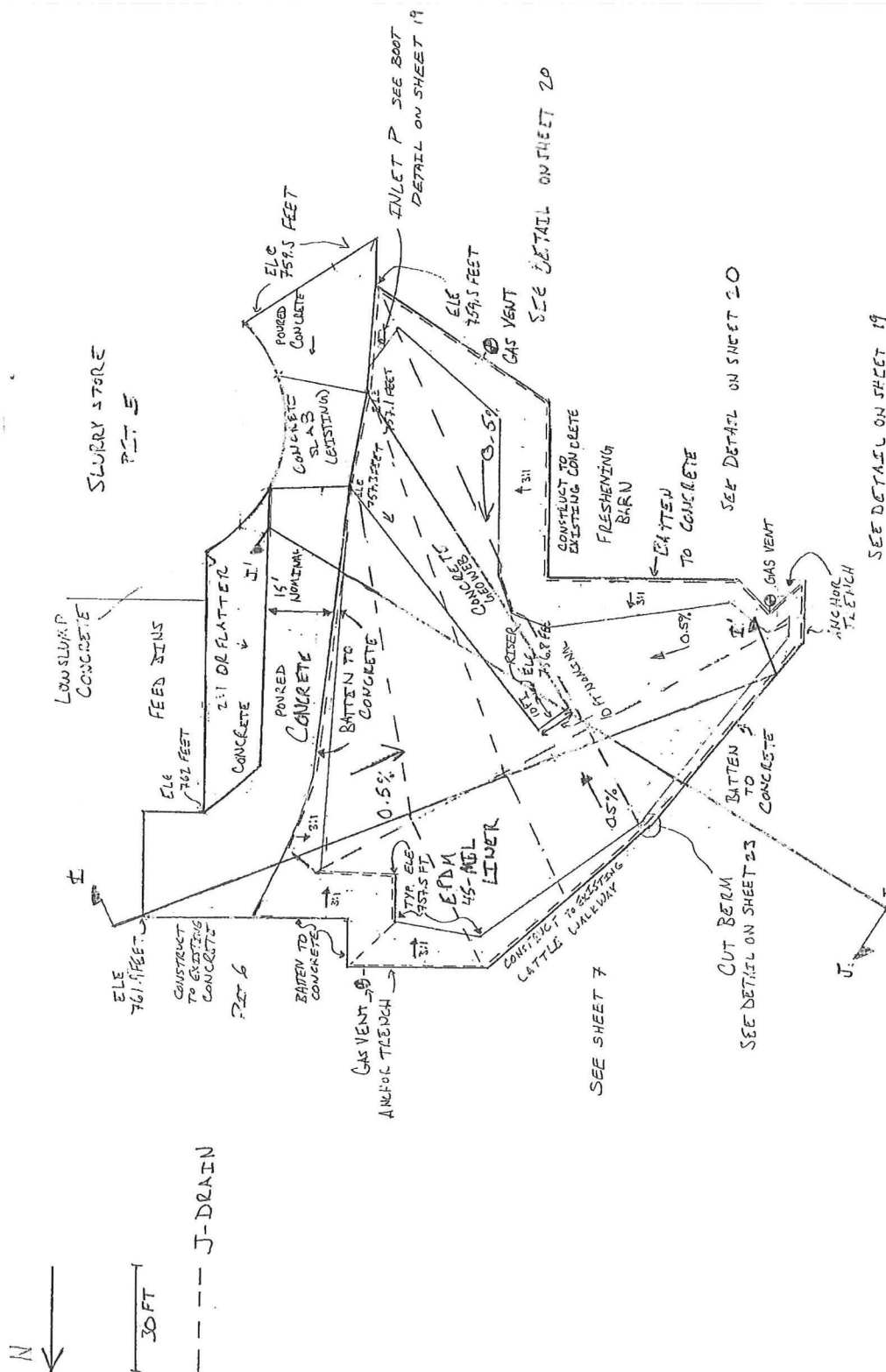
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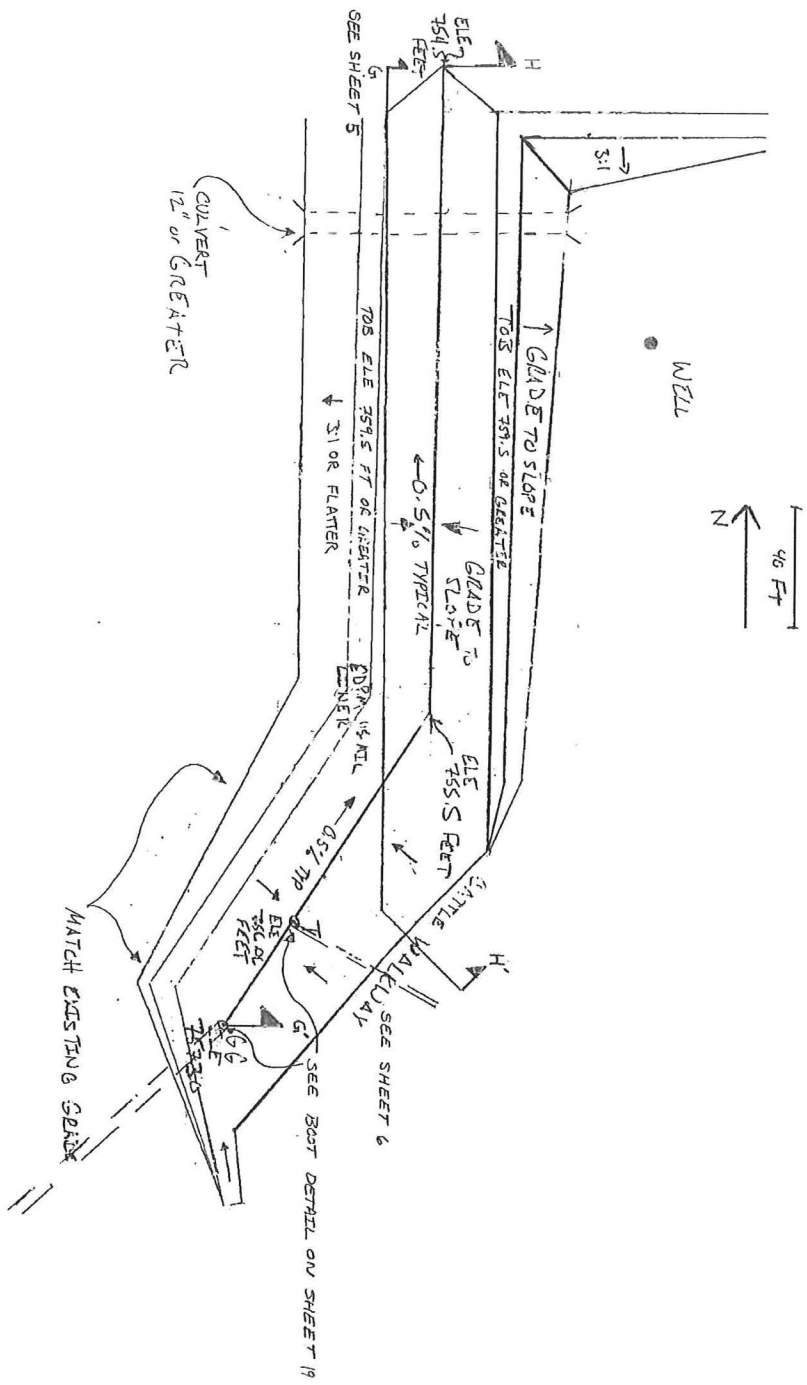
— STORAGE FLOW DIRECTION


STRUCTURE	DESCRIPTION	ELEVATION
1	15' DIA	15.24
2	15' DIA	15.24
3	15' DIA	15.24
4	15' DIA	15.24
5	15' DIA	15.24
6	15' DIA	15.24
7	15' DIA	15.24
8	15' DIA	15.24
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82	15' DIA	15.24
83	15' DIA	15.24
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85	15' DIA	15.24
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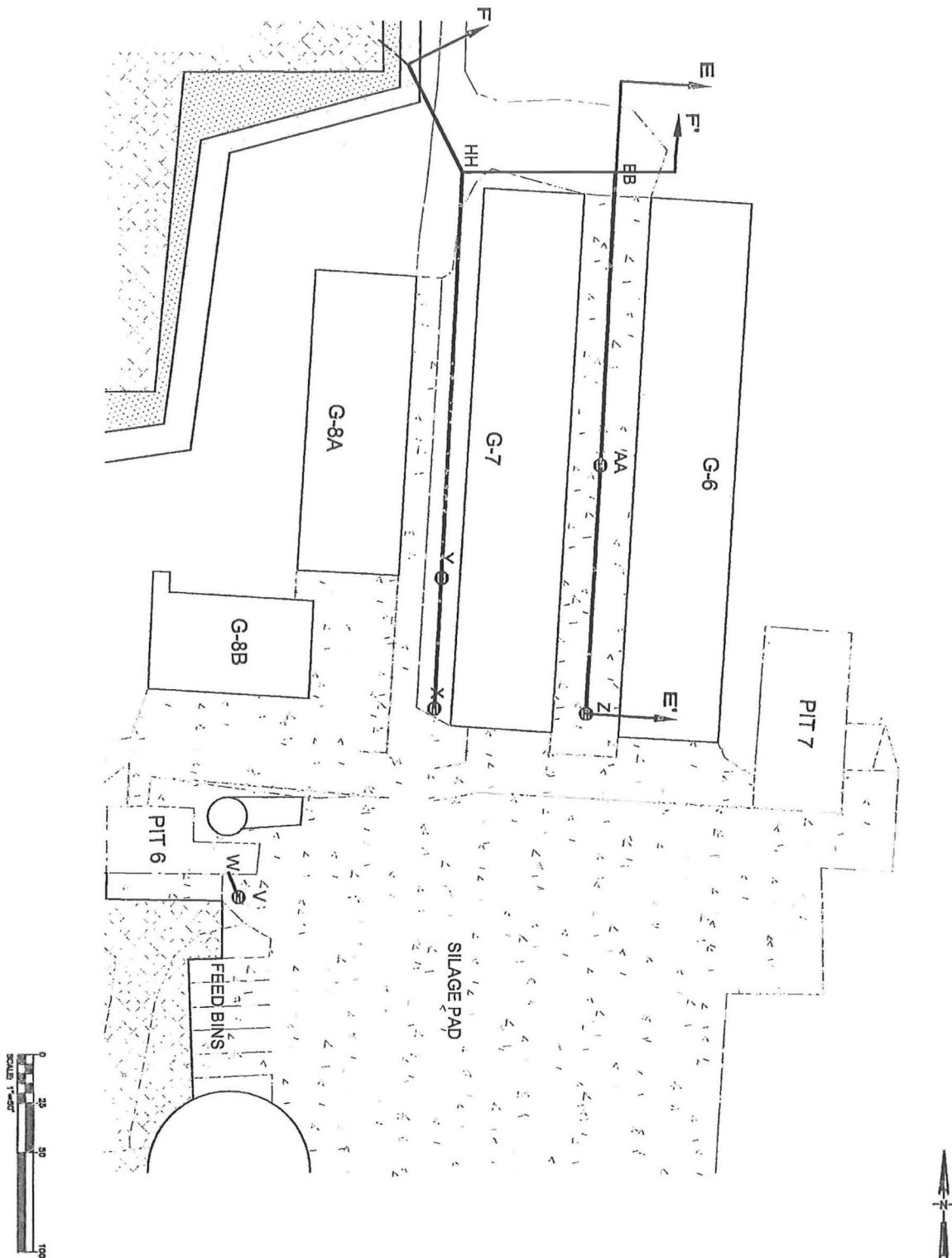
SHEET: 5	DATE: AUG 2004	Walnutdale Dairy Farm STORAGE STRUCTURE PLAN VIEW Storm Water Control & Storage Structures	PROJECT NO: 13-02064 SCALE: AS SHOWN DRAWN BY: PCW CHECKED BY: MEG	NTH Consultants, Ltd. Infrastructure Engineering and Environmental Services Farmington Hills, Detroit, Exton, Grand Rapids, Lansing
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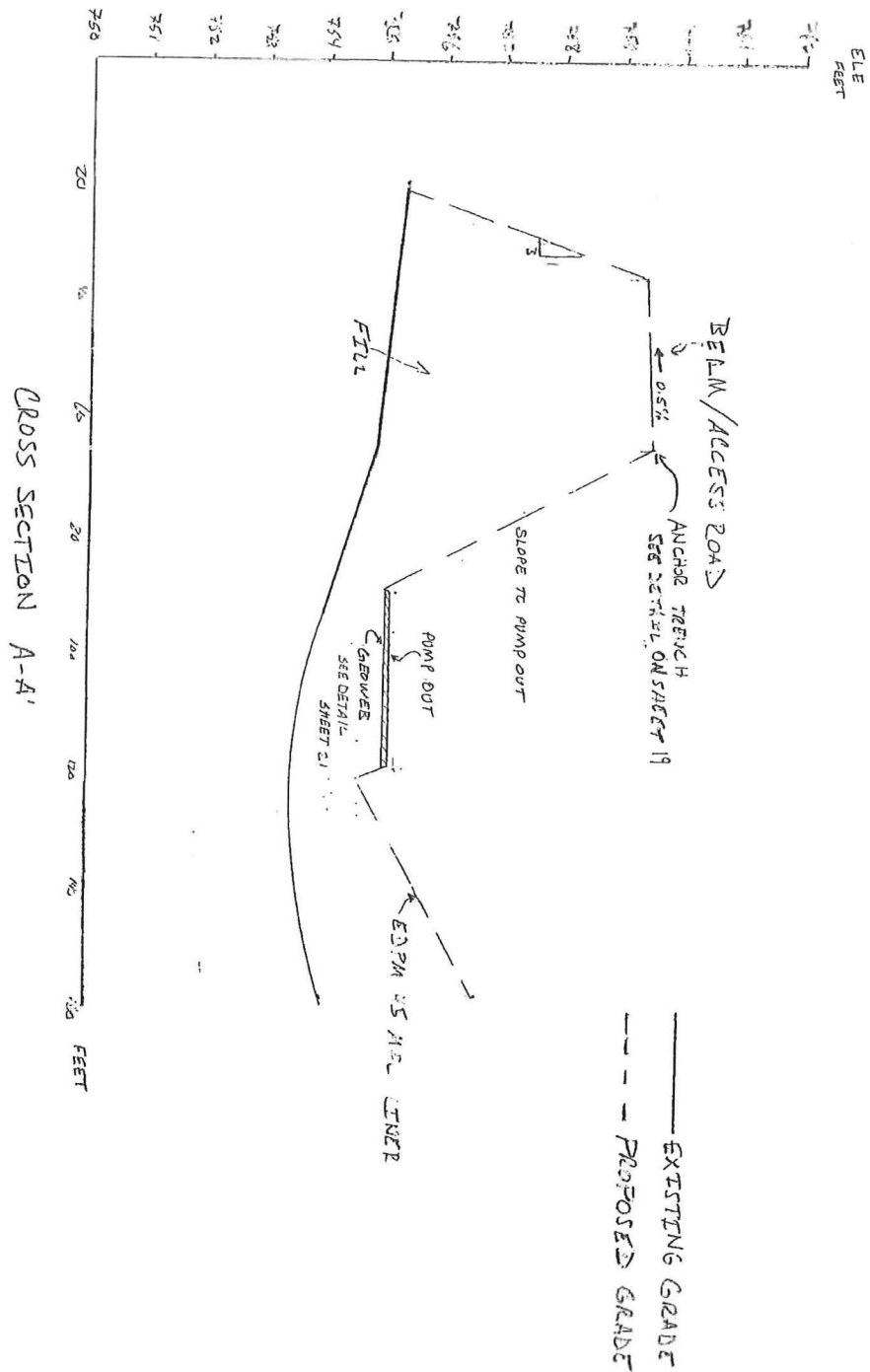





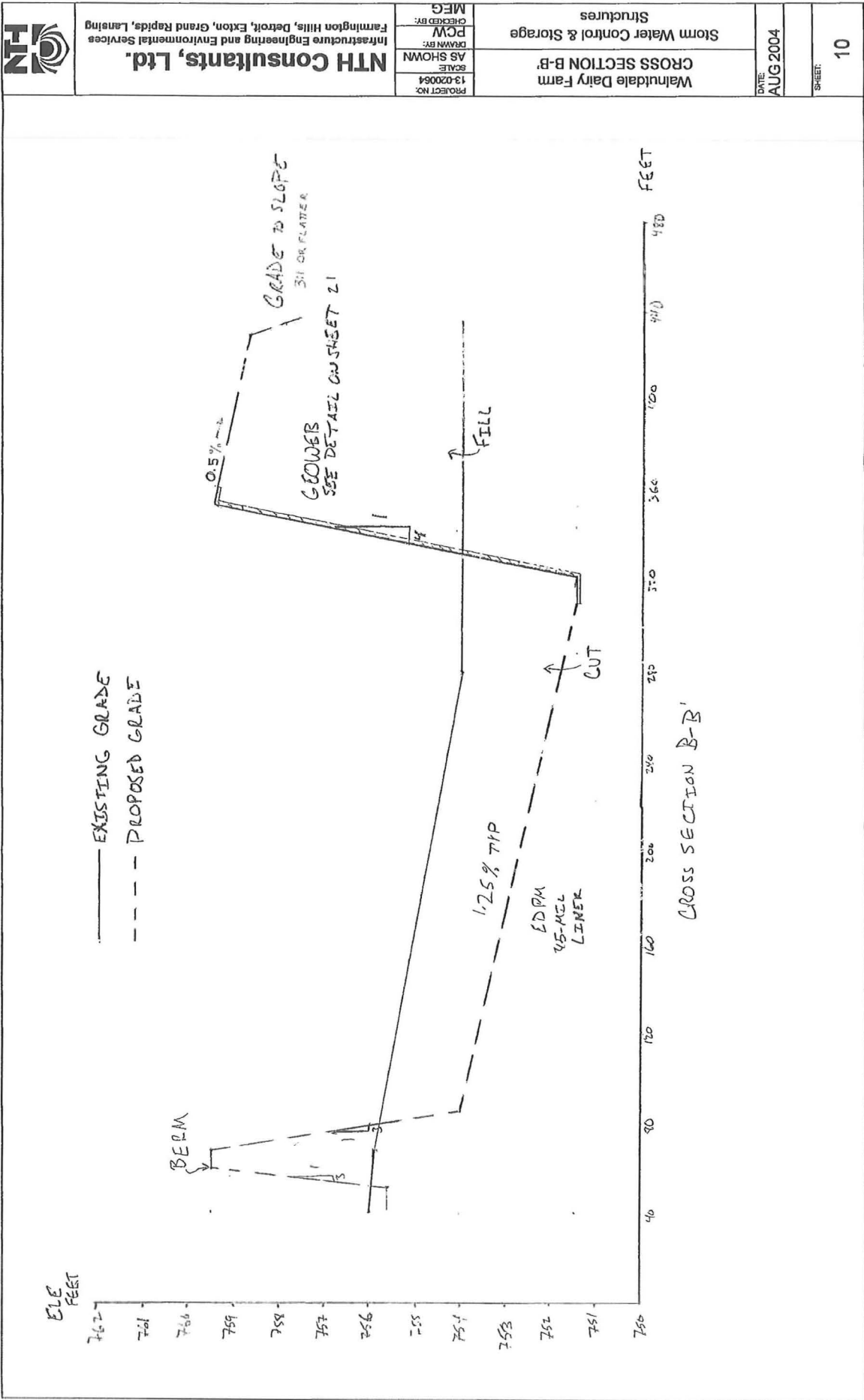
	NTH Consultants, Ltd. Infrastructure Engineering and Environmental Services Farmington Hills, Detroit, Exton, Grand Rapids, Lansing	PROJECT NO: 13-020004 SCALE: AS SHOWN DRAWN BY: PCW CHECKED BY: MEG	Walnutdale Dairy Farm CONVEYANCE PLAN VIEW Storm Water Control & Storage Structures	DATE: AUG 2004	SHEET: 7

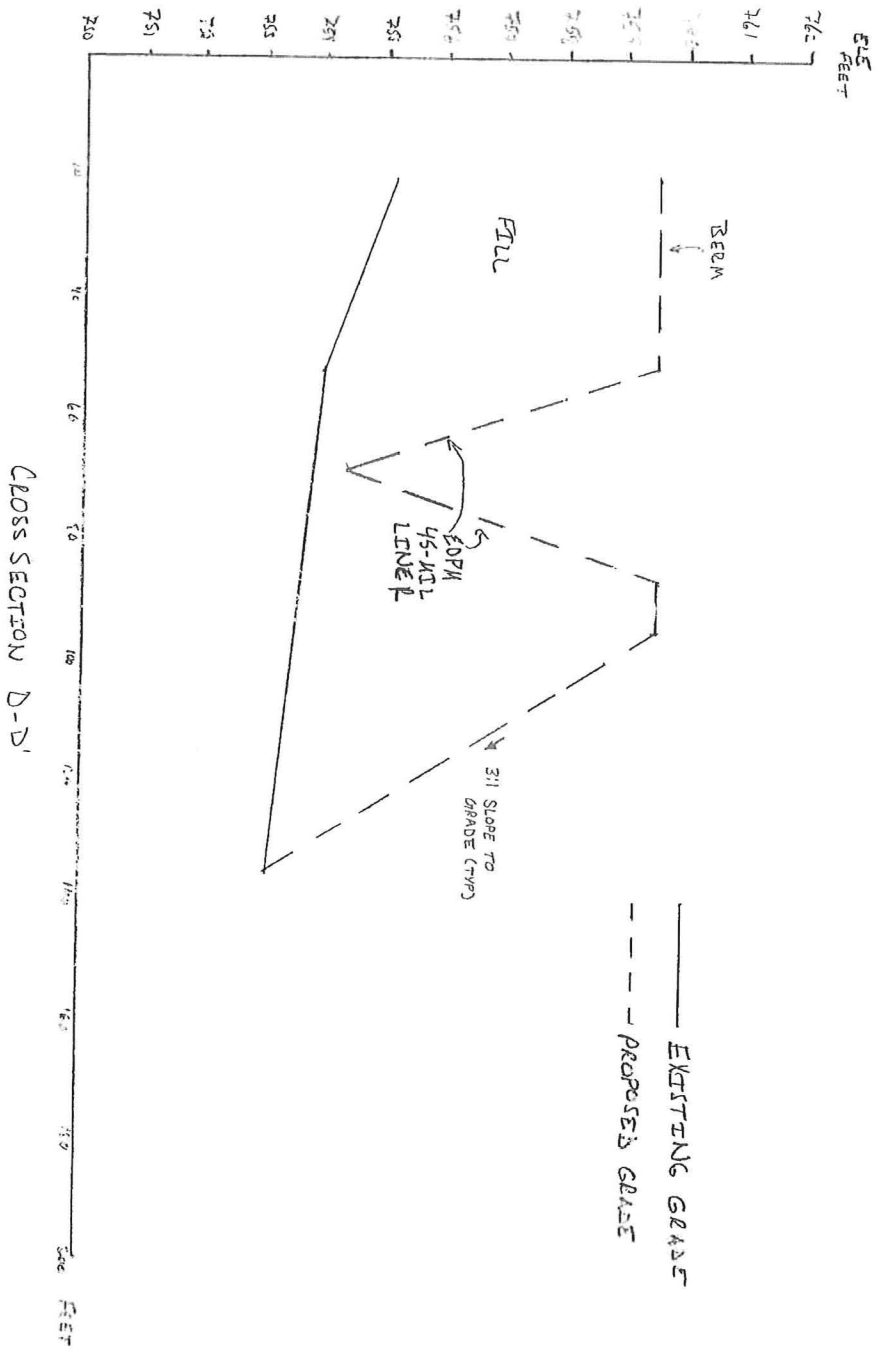


<p>FIGURE</p> <p>8</p>	<p>WALNUTDALE DAIRY FARM TIE-IN PLAN VIEW</p> <p>WAYLAND TOWNSHIP ALLEGAN COUNTY, MICHIGAN</p>	<p>NTH PROJECT No.: 13-020064</p> <p>DESIGNED BY: P.C.W.</p> <p>DRAWN BY: J.M.R.</p> <p>CHECKED BY:</p>	<p>CAD FILE NAME: 020064006</p> <p>PLOT DATE: 9-14-04</p> <p>DRAWING SCALE: AS SHOWN</p> <p>ADOPTION DATE: 8-16-04</p>	<p> NTH Consultants, Ltd.</p> <p>Infrastructure Engineering and Environmental Services</p>




	NTH Consultants, Ltd. Infrastructure Engineering and Environmental Services Farmington Hills, Detroit, Exton, Grand Rapids, Lansing	PROJECT NO: 13-020084 SCALE: AS SHOWN DRAWN BY: PCW CHECKED BY: MEG	Walnutdale Dairy Farm CROSS SECTION A-A' Storm Water Control & Storage Structures	DATE: AUG 2004	SHEET: 9

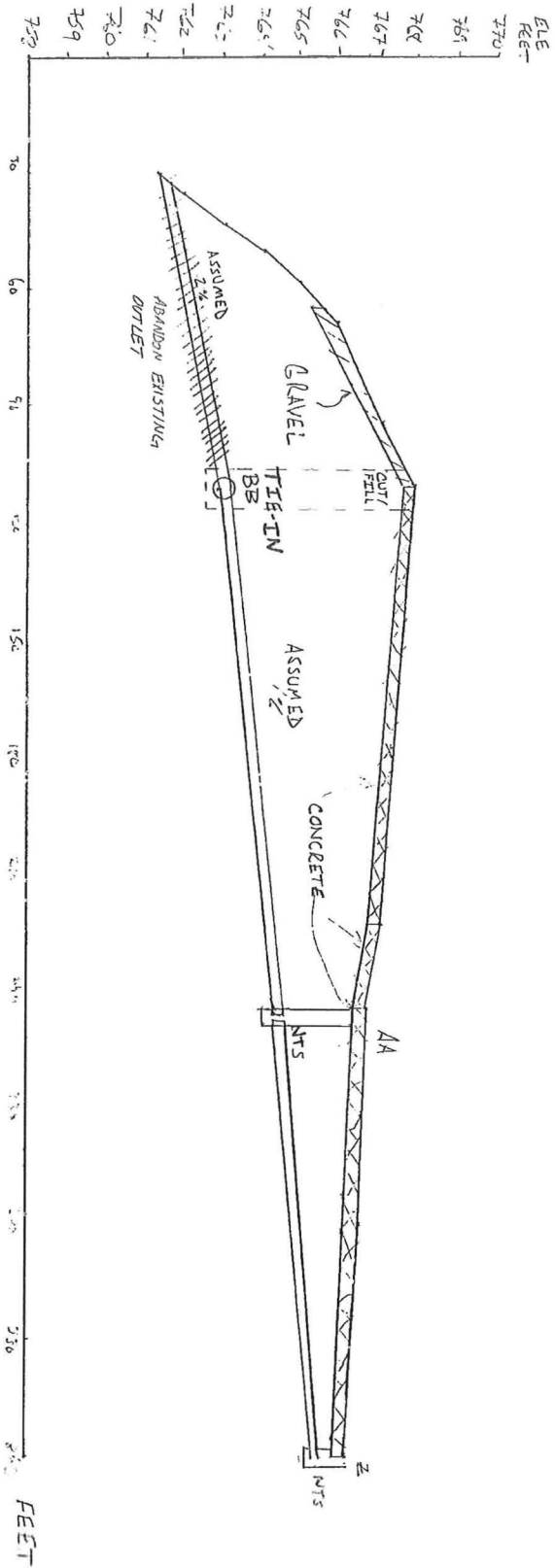




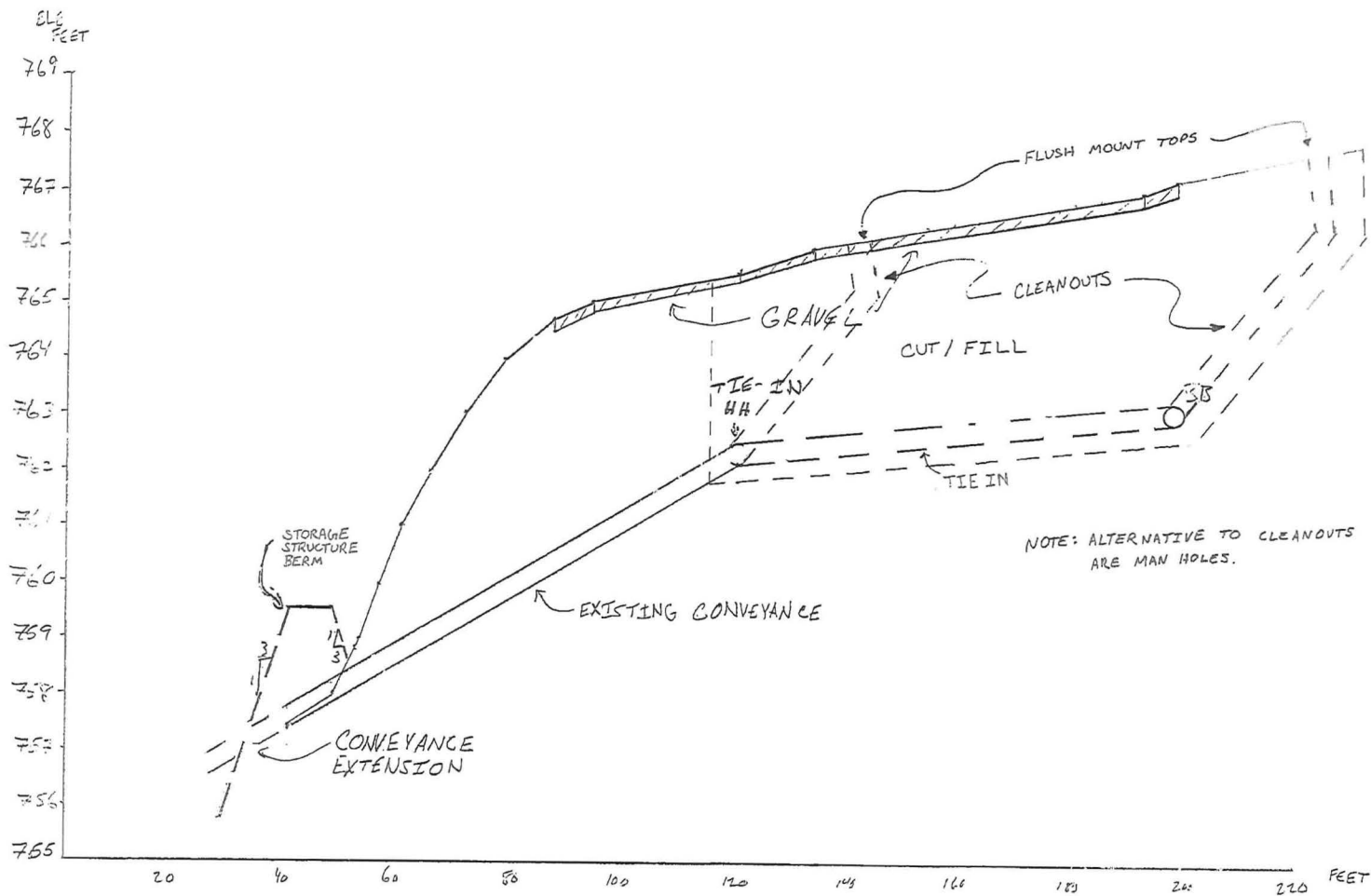
CROSS SECTION D-D'

	NTH Consultants, Ltd. Infrastructure Engineering and Environmental Services Farmington Hills, Detroit, Exton, Grand Rapids, Lansing	PROJECT NO: 13-020064 SCALE: AS SHOWN DRAWN BY: DCW CHECKED BY: MEG	Walnutdale Dairy Farm CROSS SECTION D-D' Storm Water Control & Storage Structures	DATE: AUG 2004	SHEET: 12

CROSS SECTION E-E'



	NTH Consultants, Ltd. Infrastructure Engineering and Environmental Services Farmington Hills, Detroit, Exton, Grand Rapids, Lansing	PROJECT NO: 13-020064 SCALE: AS SHOWN DRAWN BY: PCW CHECKED BY: MEG	Walnutdale Dairy Farm CROSS SECTION E-E' Storm Water Control & Storage Structures	DATE: AUG 2004 SHEET: 13
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CROSS SECTION F-F'



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Infrastructure Engineering and Environmental Services
Farmington Hills, Detroit, Exton, Grand Rapids, Lansing

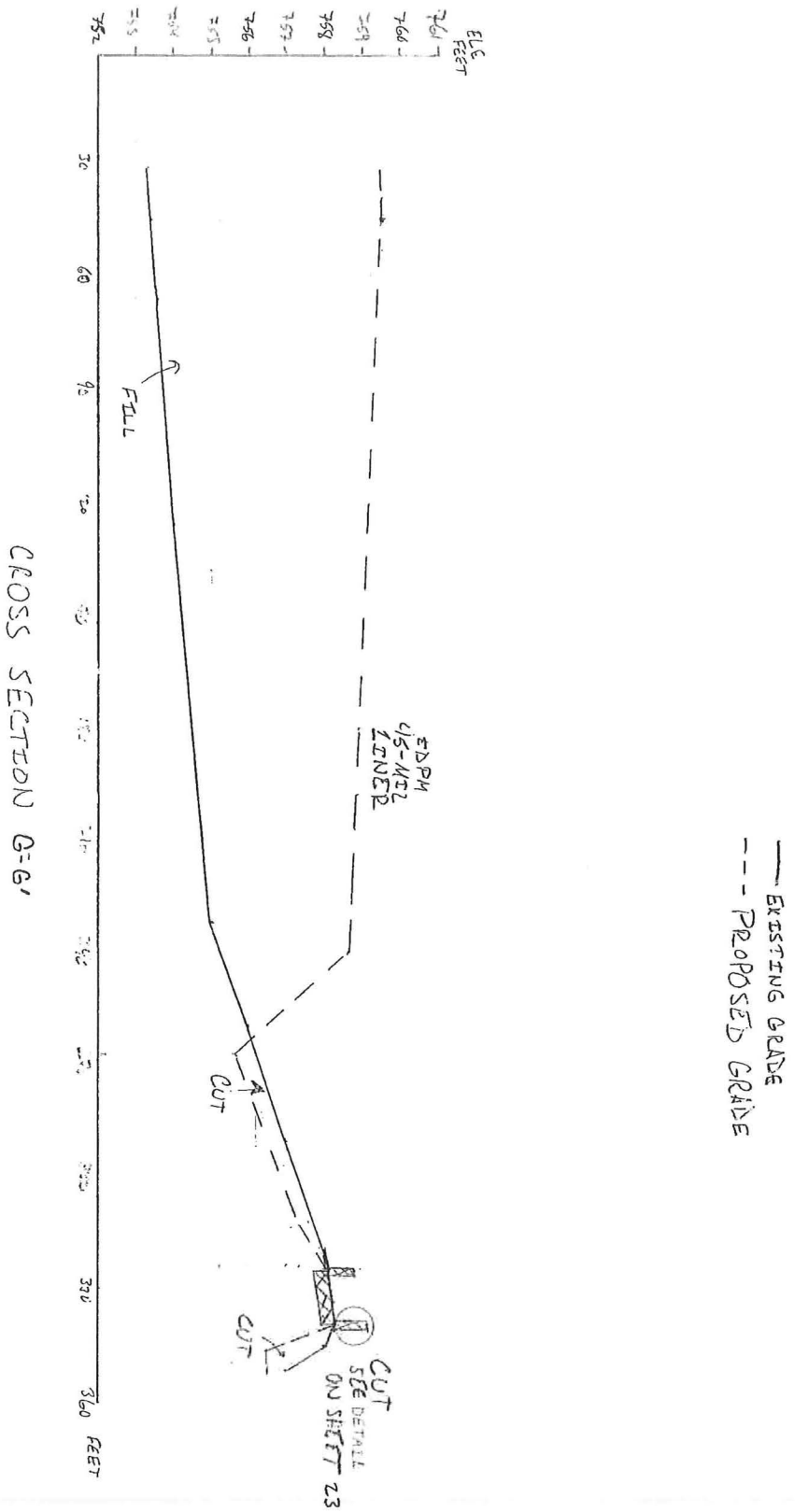
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13-020084
SCALE:
AS SHOWN
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PCW
CHECKED BY:
MEG


Walnutdale Dairy Farm
CROSS SECTION F-F'
Storm Water Control & Storage
Structures

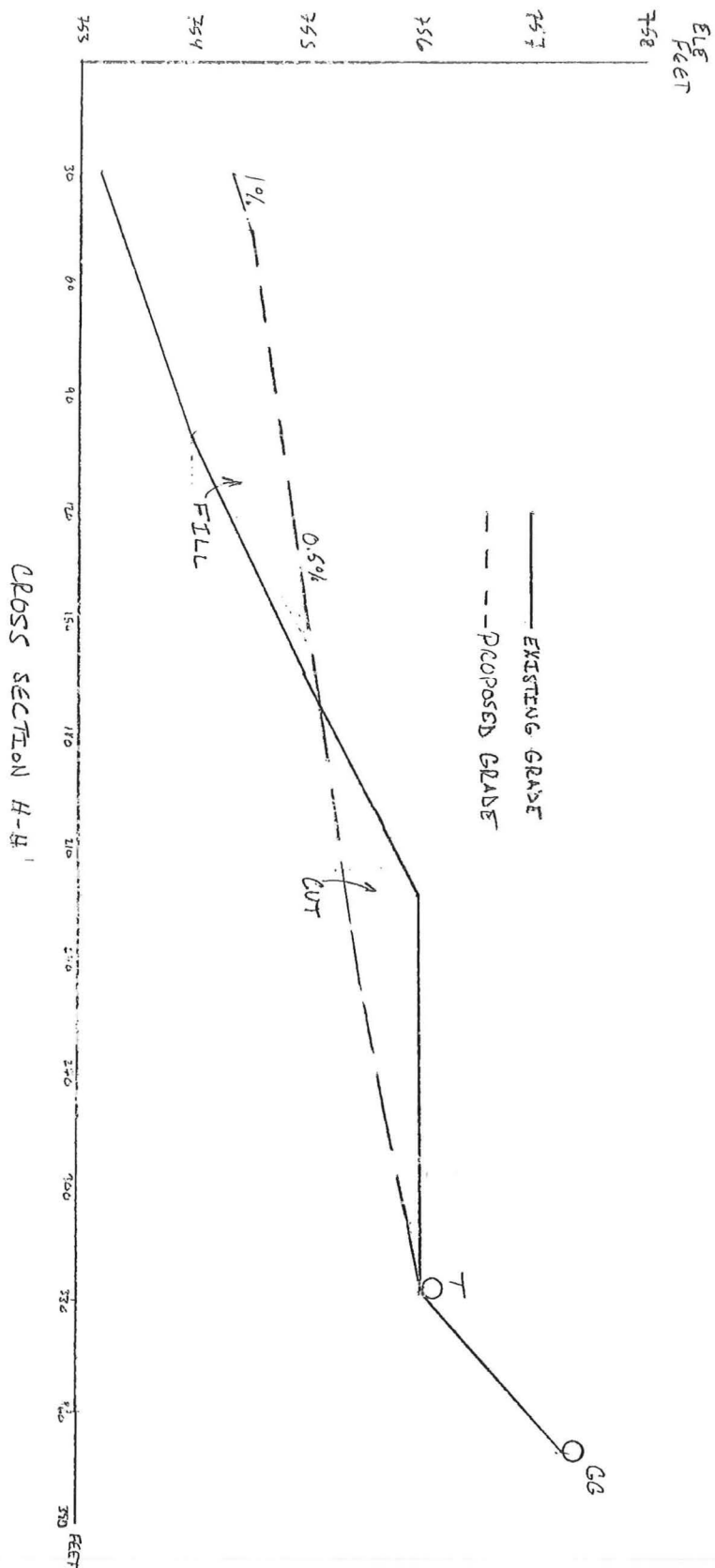
AUG 2004
Revised SEPT 2004


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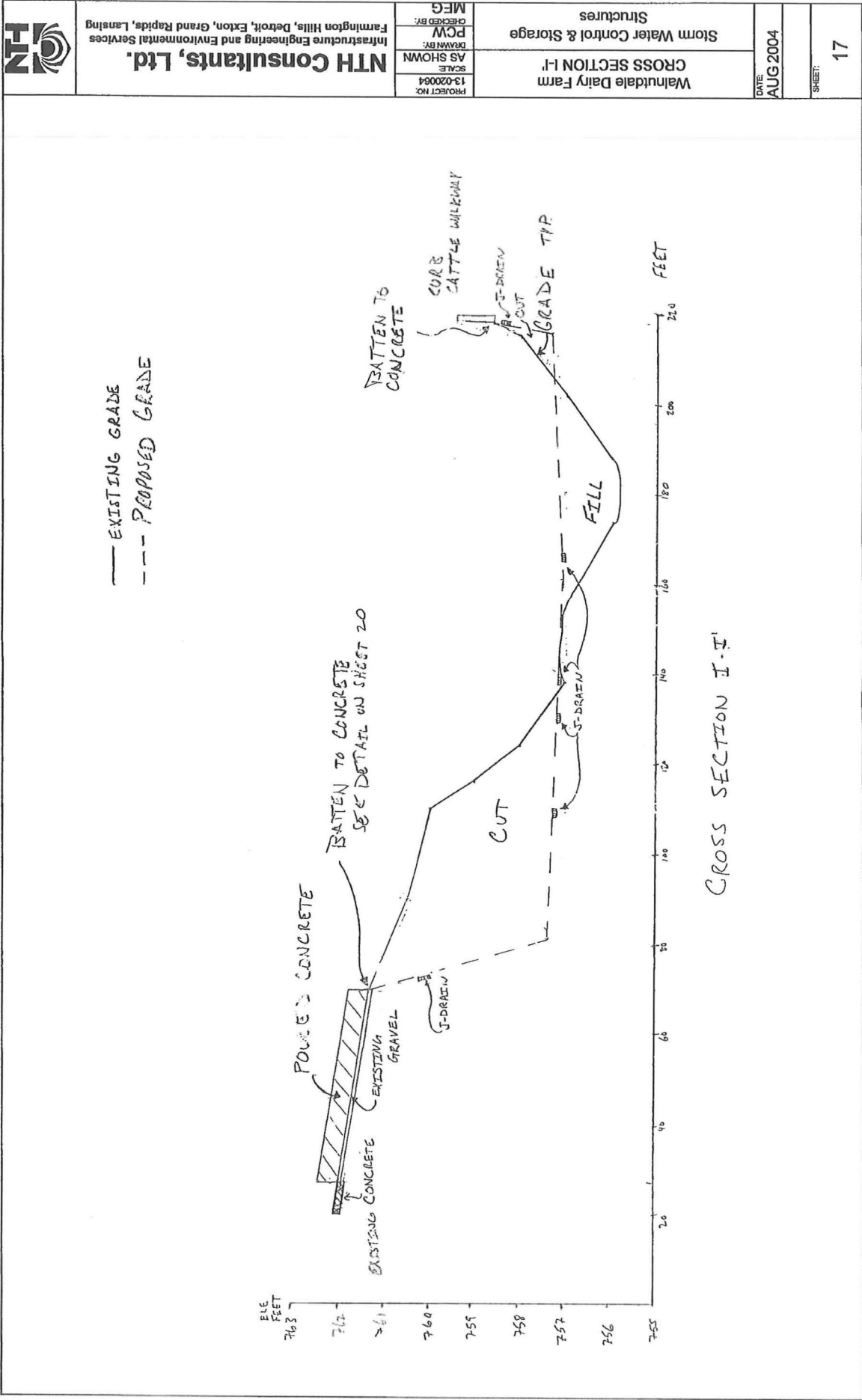
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	NTH Consultants, Ltd. Infrastructure Engineering and Environmental Services Farmington Hills, Detroit, Exton, Grand Rapids, Lansing	PROJECT NO: 13-020084 SCALE: AS SHOWN DRAWN BY: PCW CHECKED BY: MEG	Walnutdale Dairy Farm CROSS SECTION G-G' Storm Water Control & Storage Structures	DATE: AUG 2004 SHEET: 15



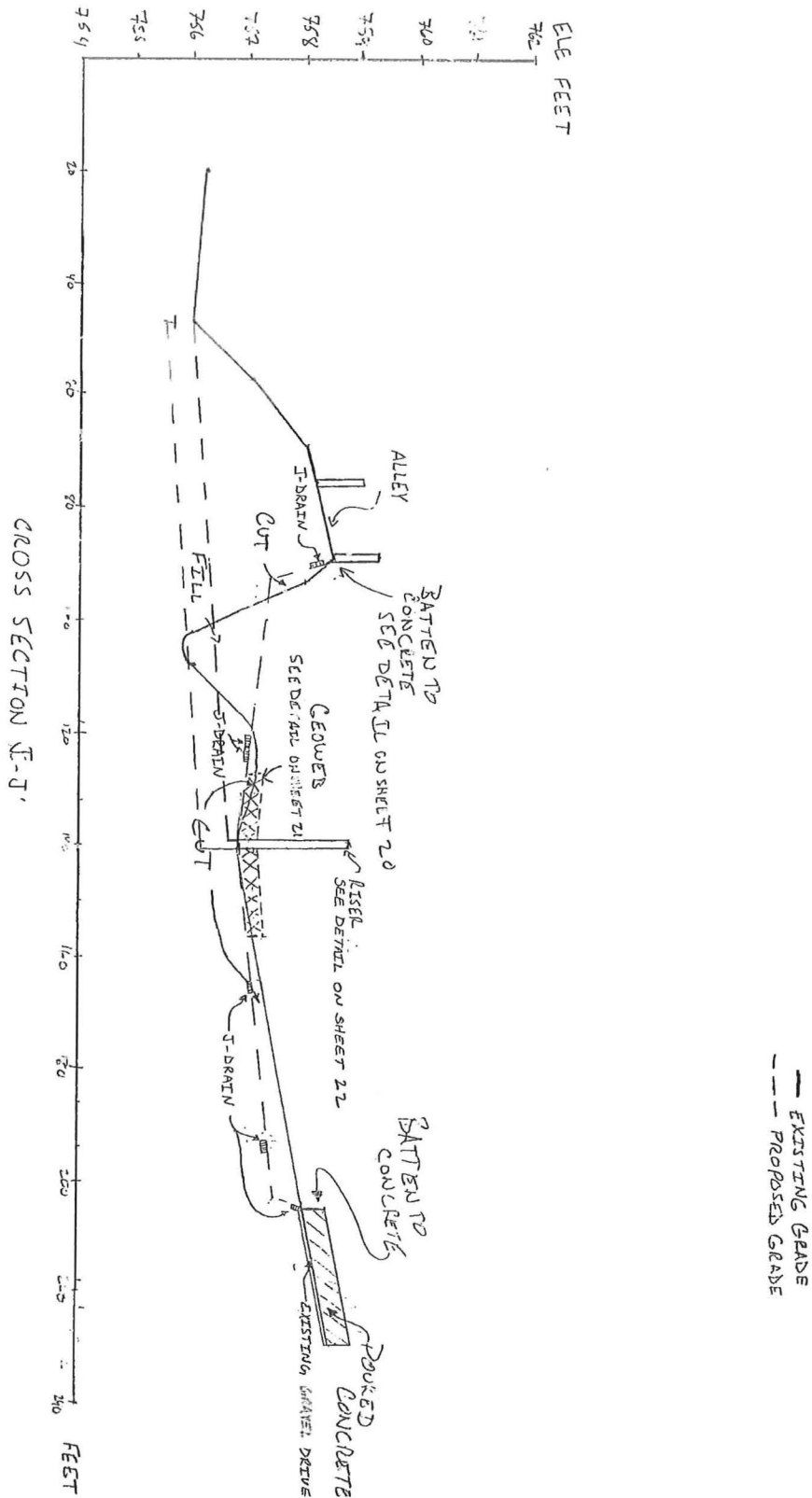
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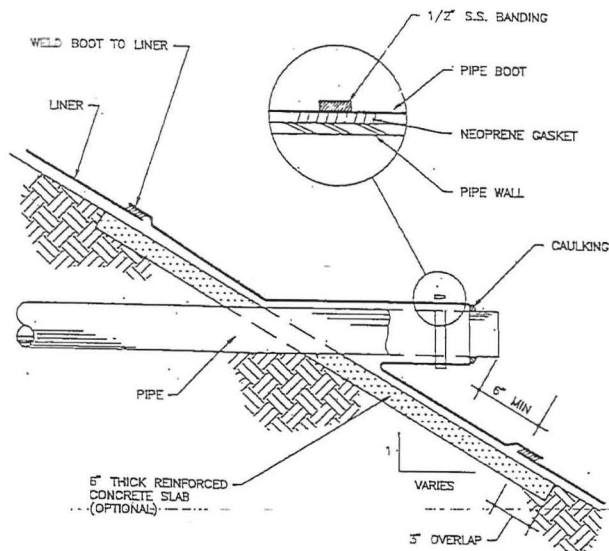
Cross Section I-I

DATE: AUG 2004	Storm Water Control & Storage Structures
SHEET: 17	Wainutdale Dairy Farm CROSS SECTION I-I
PROJECT NO: 13-020064	SCALE: AS SHOWN
DRAWN BY: PCW	CHECKED BY: MEG
Infrastructure Engineering and Environmental Services Farmington Hills, Detroit, Exton, Grand Rapids, Lansing	



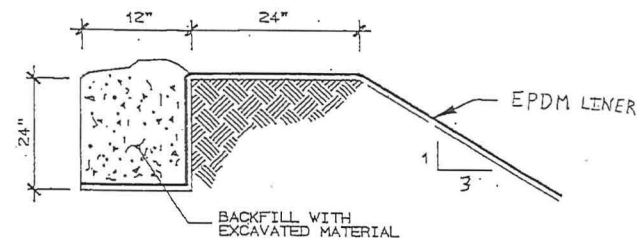


	NTH Consultants, Ltd. Infrastructure Engineering and Environmental Services Farmington Hills, Detroit, Exton, Grand Rapids, Lansing	PROJECT NO: 13-020084 SCALE: AS SHOWN DRAWN BY: PCW CHECKED BY: MEG	Walnutdale Dairy Farm CROSS SECTION J-J' Storm Water Control & Storage Structures	DATE: AUG 2004 SHEET: 18
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PIPE BOOT DETAIL

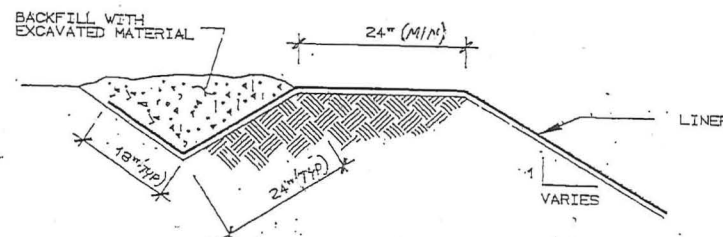
N.T.S.



STANDARD ANCHOR TRENCH

SINGLE LINER SYSTEM

NTS



\"/>

NTS

NOTE:

1. THE ABOVE DIMENSIONS ARE SUGGESTED MINIMUM STANDARDS; ACTUAL DISTANCES TO BE DETERMINED BASED ON SITE SPECIFIC CRITERIA SUCH AS SOIL CONDITIONS, CLIMATIC CONDITIONS, MATERIAL THICKNESS, SLOPE ANGLE AND SLOPE LENGTH AS DETERMINED BY THE DESIGN ENGINEER.
2. BACKFILL SHOULD BE SUFFICIENTLY COMPACTED TO PREVENT LINER PULLOUT.



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Farmington Hills, Detroit, Exton, Grand Rapids, Lansing

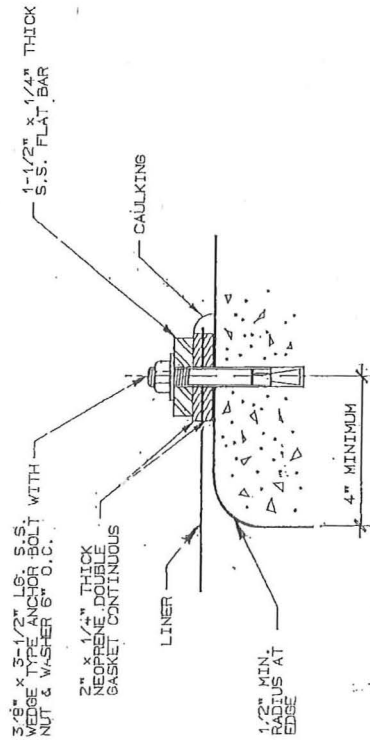
PROJECT NO:
13-020004
DATE:
AS SHOWN
DRAWN BY:
PCW
CHECKED BY:
MEG

Wainutdale Dairy Farm
BOOT AND TRENCH DETAILS
Storm Water Control & Storage
Structures

DATE:
AUG 2004

SHEET:

19

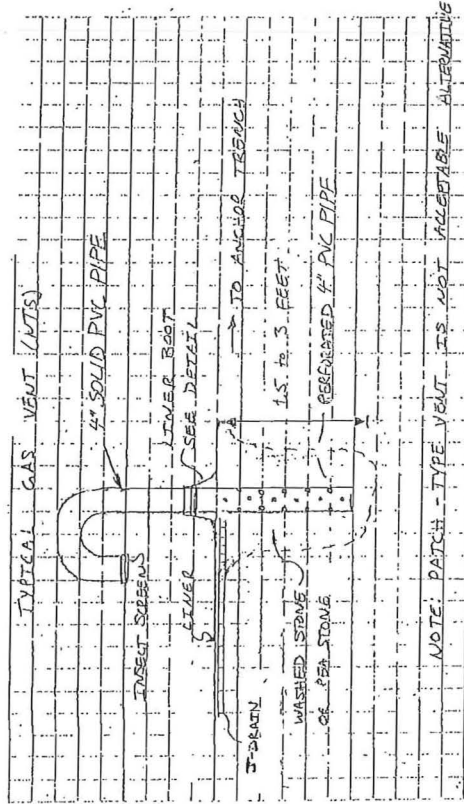


TYPICAL CONCRETE ATTACHMENT

BATTEN TYPE

NOTE:

1. CONCRETE SURFACES AT ATTACHMENT LOCATIONS TO BE STEEL TROWEL FINISHED OR GROUND SMOOTH PRIOR TO INSTALLATION.



NOTE: PATCH-TYPE VENT IS NOT ACCEPTABLE ALTERNATIVE



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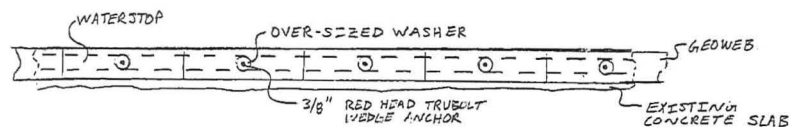
Wainutdale Dairy Farm
BATTEN AND GAS VENT DETAILS
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Structures

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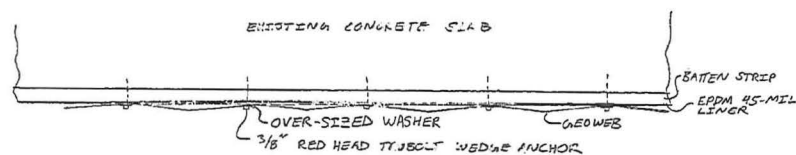
20

GEOWEB ATTACHMENT TO EXISTING CONCRETE



PROFILE VIEW

NOTE: UNDERLAY GEOWEB WITH 4553 8 OZ NONWOVEN GEOTEXTILE



PLAN VIEW

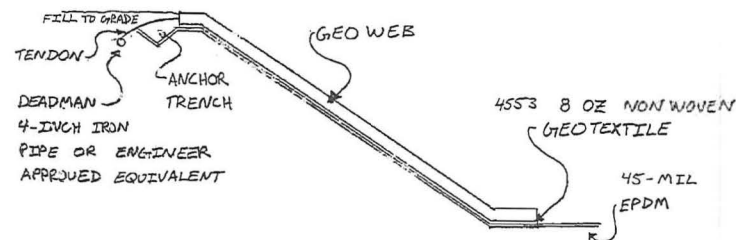
STORAGE STRUCTURE PUMP OUT RAMP (NTS)

NOTE:
USE 5 TENDONS PER
GEOWEB PANEL.
TK89 WOVEN KEVLAR
TENDON OR ENGINEER
APPROVED EQUIVALENT



NOTE:
CLIP EACH TENDON
TO GEOWEB EVERY
5 CELLS

PLAN VIEW



PROFILE



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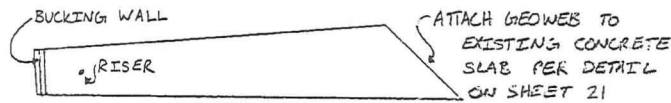
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Wainutdale Dairy Farm
GEOWEB DETAILS
Storm Water Control & Storage
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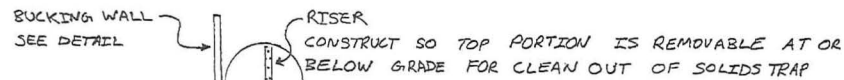
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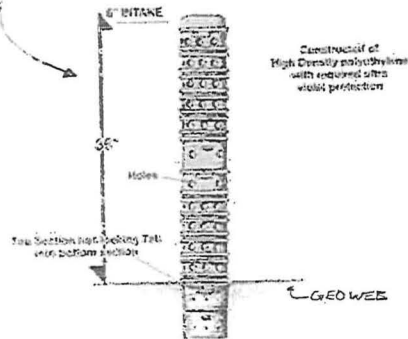
SOLIDS TRAP CLEAN OUT PAD AND RISER (NTS)



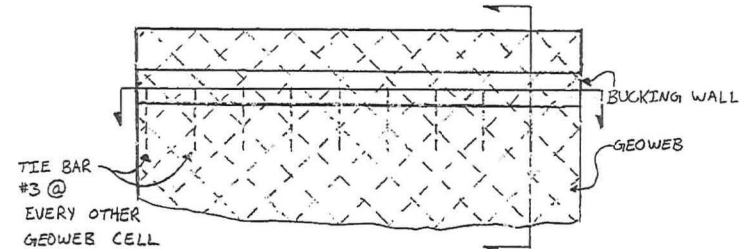
PLAN VIEW



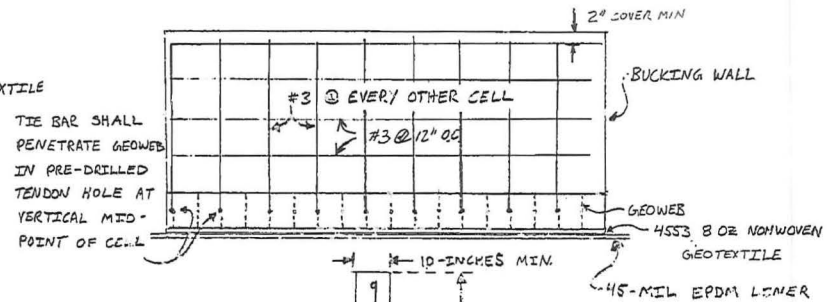
PROFILE



SOLIDS TRAP BUCKING WALL (NTS)



PLAN VIEW



CROSS SECTIONS



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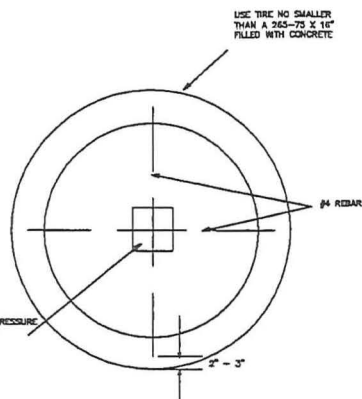
Walnutdale Dairy Farm
BUCKING WALL / RISER DETAILS
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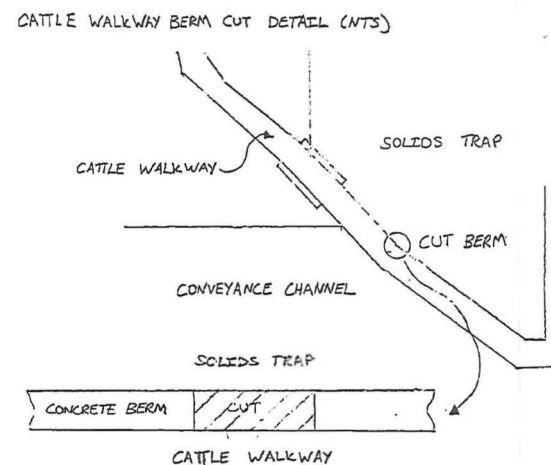
22

(N.T.S.)



PLAN VIEW - TRUCK TIRE
(N.T.S.)

- NOTE: TO BE PLACED AT THE BOTTOM
OF THE PUMP/OUT RAMP.
ELEVATIONS MAY VARY BASED
ON FINAL GRADE AND
DIMENSIONS.



NOTE: CUT SHALL BE EIGHT TO TWELVE INCHES



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Walnutdale Dairy Farm

Walnutdale Dairy Farm
ALLEY CUT and FREEBOARD
INDICATOR DETAILS

INDICATOR DETAILS

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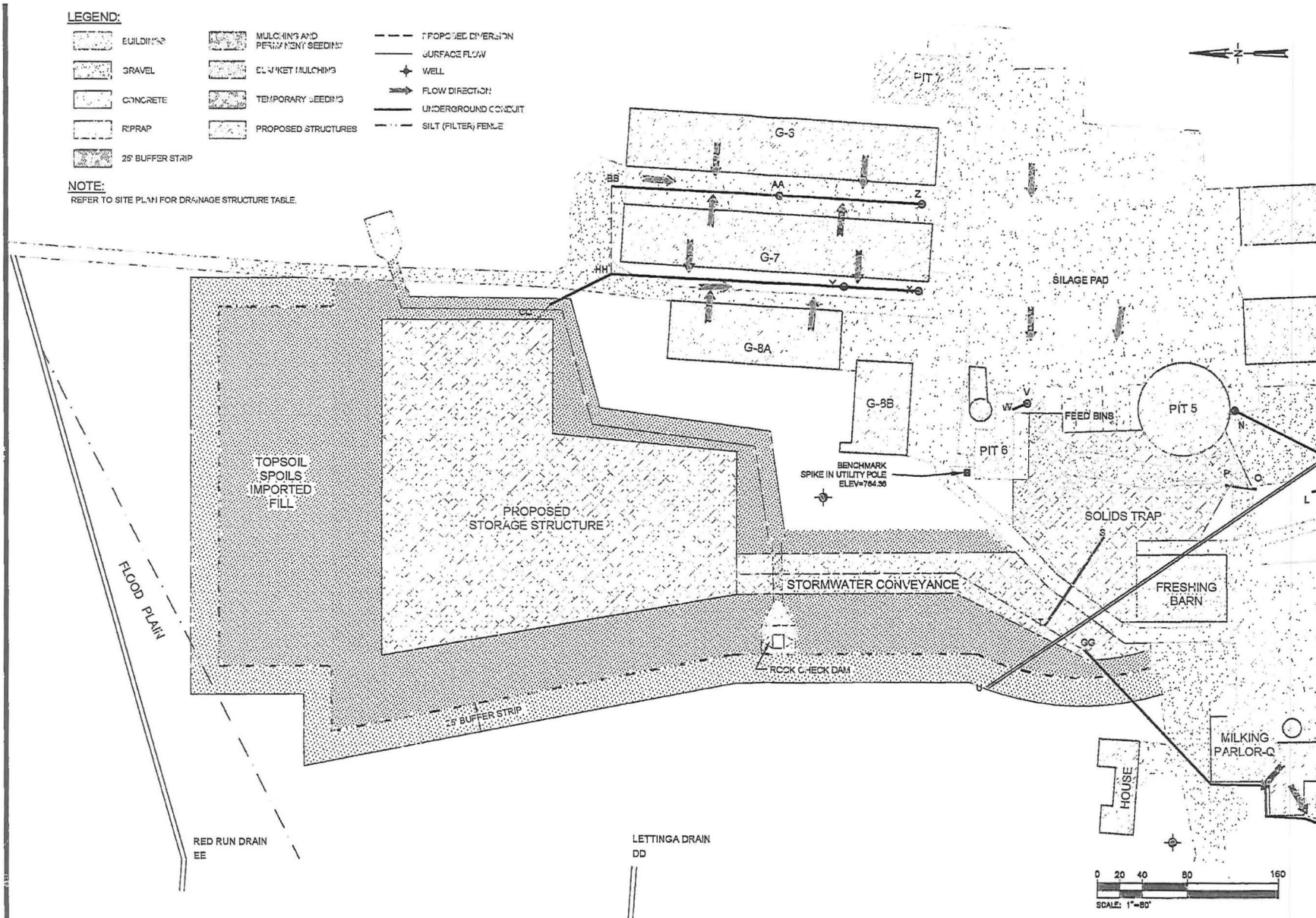
23

LEGEND:

	BUILDING		MULCHING AND PERMEABLE SEEDING		PROPOSED DIRECTION
	GRAVEL		CLAY MULCH		SURFACE FLOW
	CONCRETE		TEMPORARY SEEDING		WELL
	RIPRAP		PROPOSED STRUCTURES		FLOW DIRECTION
	25' BUFFER STRIP				UNDERGROUND CONDUIT
					SILT (FILTER) FENCE

NOTE:

REFER TO SITE PLAN FOR DRAINAGE STRUCTURE TABLE.



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CAD FILE NAME	020064005
PLAN DATE	8-7-04
DESIGNED BY	AS SHOWN
DRAWN BY	JMR
CHECKED BY	8-9-04

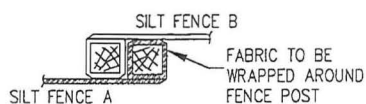
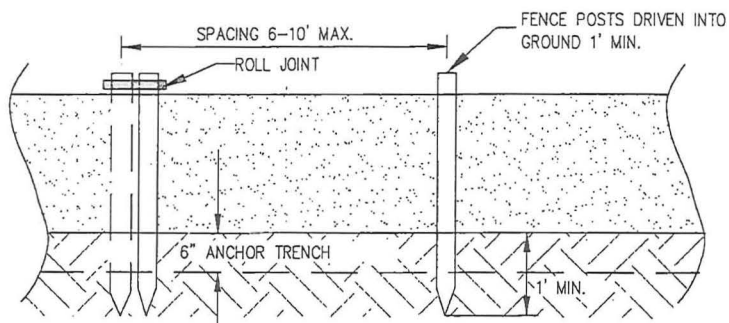
NTH PROJECT NO.	13-020064
DESIGNED BY	P.C.W.
DRAWN BY	JMR
CHECKED BY	

WALNUTDALE DAIRY FARM
SOIL EROSION CONTROL PLAN
WAYLAND TOWNSHIP
ALLEGAN COUNTY, MICHIGAN

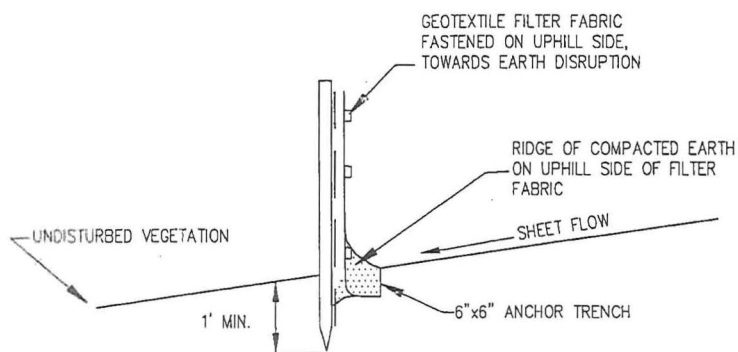
FIGURE

24

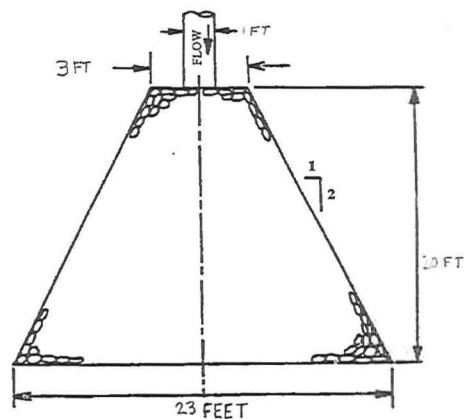
SILT FENCE



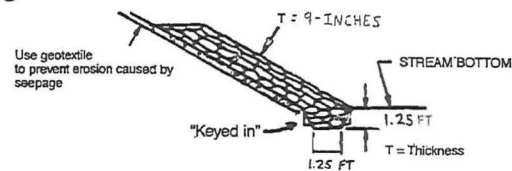
ROLL JOINTS



RIPRAP



"Keying in"



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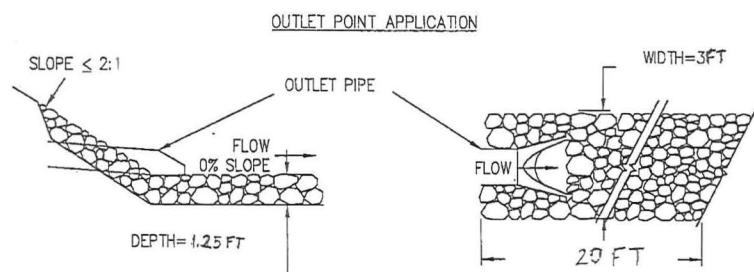
Walnutdale Dairy Farm
SILT FENCE / RIP RAP DETAILS
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RIPRAP



SIZE OF TYPICAL RIPRAP STONES			
Weight (lbs.)	Average Spherical Diameter (in.) D_{50}	Typical Rectangular Shape Length (in.)	Width/Height (in.)
50	10	18	6
100	13	21	7
150	14	24	8
300	18	30	10
500	22	36	12
1000	27	45	15
1500	31	52	17
2000	34	57	19
4000	43	72	24
6000	49	83	28
8000	54	90	30

Source: Adapted from USDA NRCS

RIPRAP SPECIFICATIONS

1. Review subject site to identify areas subject to concentrated flows or wave/current attack.
2. The appropriateness and extent of riprap placement is site specific and should be determined in the field.
3. The area under review for riprap placement must be shaped and contoured appropriately by grading prior to material placement.
4. Non-woven geotextile fabric should be installed prior to riprap placement, with upper end and toe end of fabric buried or anchored to prevent movement.
5. Riprap placement should be started at a stabilized location and ended at a stabilized or contoured point.
6. Material selected for riprap should be hard, angular, and resistant to weathering. Appropriate material size depends on expected water energy and intended function of the material.
7. Riprap mixture should be an even mixture of stone sizes based on the average, or D_{50} . This means 50% of the stone, by size, will be larger than the diameter specified, and 50% will be smaller than the size specified. The diameter of the largest stone should not be more than 1.5 times the D_{50} stone size.
8. See table on the following page for typical riprap stone sizes.
9. Rock shall be placed so that larger rocks are uniformly distributed and in contact with one another. Smaller rocks should fill the voids.
10. When in contact with moving water, riprap will tie into a stable bank at the downstream end and will be keyed into the bank at the upstream end. Riprap should extend 3 ft. above the ordinary high water mark or to the top of the bank on short slopes. Extend riprap a minimum 10 ft. beyond active erosion area.



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RIP RAP DETAILS

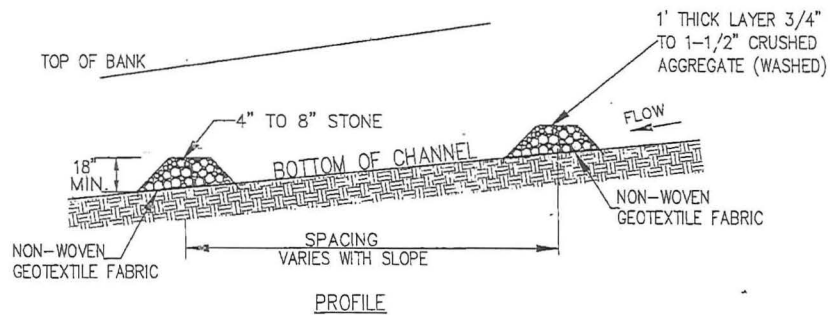
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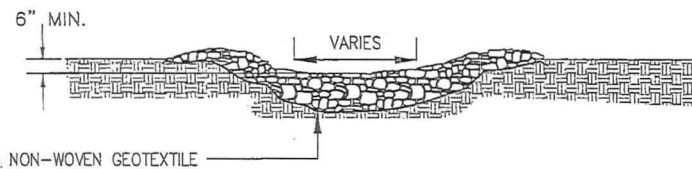
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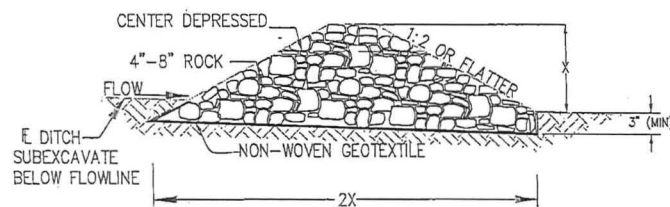
CHECK DAM



PROFILE



CROSS SECTION



PROFILE

NOTE: BASE WIDTH SHOULD BE AT LEAST 2X THE HEIGHT.

CHECK DAM SPECIFICATIONS

1. The check dam shall be constructed of rock only.
2. The rock shall be placed on non-woven geotextile fabric.
3. Remove woody vegetation prior to placing non-woven geotextile fabric.
4. Non-woven geotextile fabric shall be inset a minimum of 3" below adjacent grades.
5. The check dam shall be constructed of 4"-8" stone. The stone shall be placed to completely cover the width of the flow corridor and shall be keyed into adjacent banks.
6. The middle of the check dam shall be lower than the outer edges, such that no flow goes around the structure.
7. The up-stream side of the check dam can be lined with smaller crushed aggregate to improve efficiency.
8. Slopes of check dam should be 1:2 or flatter.



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CHECK DAM DETAILS

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TEMPORARY SEEDING SPECIFICATIONS

1. Review construction phasing and soil erosion control plan to identify areas requiring temporary seeding.
2. Select annual grass seed for temporary cover areas.
3. Seed mixes may vary, should only contain annual, non-aggressive species, and generally include rye, wheat, or oat species. Seed mixes should be obtained from a seed supplier as seed mixes are dependent on soil type, light, moisture, and use application.
4. Prepare seedbed by removal of construction/woody debris. Then scarify or rake seedbed.
5. Slopes steeper than 1:3 should be roughened.
6. Apply seed as soon as possible after seedbed preparation. Mulch immediately after seeding all slopes, unstable soils, heavy clay soils, and all areas adjacent to wetlands, watercourses, or sensitive areas.
7. The time to seed is dependent on the climate of the area. Michigan has three climatic zones.
8. Protect seeded areas from pedestrian/vehicular traffic.
9. Divert concentrated flows away from seeded area until vegetation is established.
10. Inspect temporary seeded areas weekly and following each rain event until final grading and stabilization activities are completed.
11. Must be followed by permanent seeding.

TEMPORARY SEEDING DATES

Seed Type	Zone 1	Zone 2	Zone 3	Amount	
	Lower Peninsula (South of U.S. 10)	Lower Peninsula (North of U.S. 10)	Upper Peninsula	per 1,000 sq.ft.	per acre
Oats, barley	4/1 - 9/15	4/15 - 8/1	5/1 - 8/1	2 lbs.	96 lbs.
Annual Rye	8/1 - 10/15	8/1 - 10/10	8/1 - 11/1	3 lbs.	120 lbs.
Wheat	9/20 - 10/15	9/10 - 10/10	9/10 - 10/1	3 lbs.	120 lbs.
Buckwheat	6/1 - 7/15	6/1 - 7/15	6/15 - 7/15	2 lbs.	75 lbs.
Perennial Ryegrass	8/1 - 10/15	6/1 - 8/1	8/1 - 10/1	0.5 lbs.	20 lbs.

Source: Adapted from USDA NRCS Technical Guide #342 (1999)



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PERMANENT SEEDING

Planting Zones:	Lower Peninsula (South of T20N) Zone 1	Lower Peninsula (North of T20N) Zone 2	Upper Peninsula Zone 3
Seeding Window Permanent Seeding	4/15 - 10/10	5/1 - 10/1	5/1 - 9/20
Seeding Window Dormant Seeding*	11/15 - Freeze	11/01 - Freeze	11/01 - Freeze

Source: Adapted from MDOT Interim 2003 Standard Specifications for Construction

	Zone 1 Lower Peninsula (South of U.S. 10)	Zone 2 Lower Peninsula (North of U.S. 10)	Zone 3 Upper Peninsula
Seeding Dates (with Irrigation or Mulch)	4/1 - 8/1	5/1 - 9/20	5/1 - 9/10
Seeding Dates (w/o Irrigation or Mulch)	4/1 - 5/20 or 8/10 - 10/1	5/1 - 6/10 or 8/1 - 9/20	5/1 - 6/15 or 8/1 - 9/20
Dormant Seeding Dates*	11/1 - Freeze	10/25 - Freeze	10/25 - Freeze

Source: Adapted from USDA NRCS Technical Guide #342 (1999)

* Dormant seeding is for use in the late fall after the soil temperature remains consistently below 50°F, prior to the ground freezing. This practice is appropriate if construction on a site is completed in the fall but the seed was not planted prior to recommended seeding dates. No seed germination will take place until spring. A cool season annual grass may be added in an attempt to have some fall growth.

- Mulch must be used with dormant seed.
- Do not seed when the ground is frozen or snow covered.
- Do not use a dormant seed mix on grassed waterways.

PERMANENT SEEDING SPECIFICATIONS

1. Review SESC plan and construction phasing to identify areas in need of permanent vegetative stabilization.
2. Select perennial grass and ground cover for permanent cover.
3. Seed mixes vary. However, they should contain native species.
4. Seed mixes should be selected through consultation with a certified seed provider and with consideration of soil type, light, moisture, use applications, and native species content.
5. Soil tests should be performed to determine the nutrient and pH levels in the soil. The pH may need to be adjusted to between 6.5 and 7.0.
6. Prepare a 3-5" deep seedbed, with the top 3-4" consisting of topsoil.
7. Slopes steeper than 1:3 should be roughened.
8. Apply seed as soon as possible after seedbed preparation. Seed may be broadcast by hand, hydroseeding, or by using mechanical drills.
9. Mulch immediately after seeding.
10. Dormant seed mixes are for use after the growing season, using seed which lies dormant in the winter and begins growing as soon as site conditions become favorable.
11. Protect seeded areas from pedestrian or vehicular traffic.
12. Divert concentrated flows away from the seeded area until vegetation is established.



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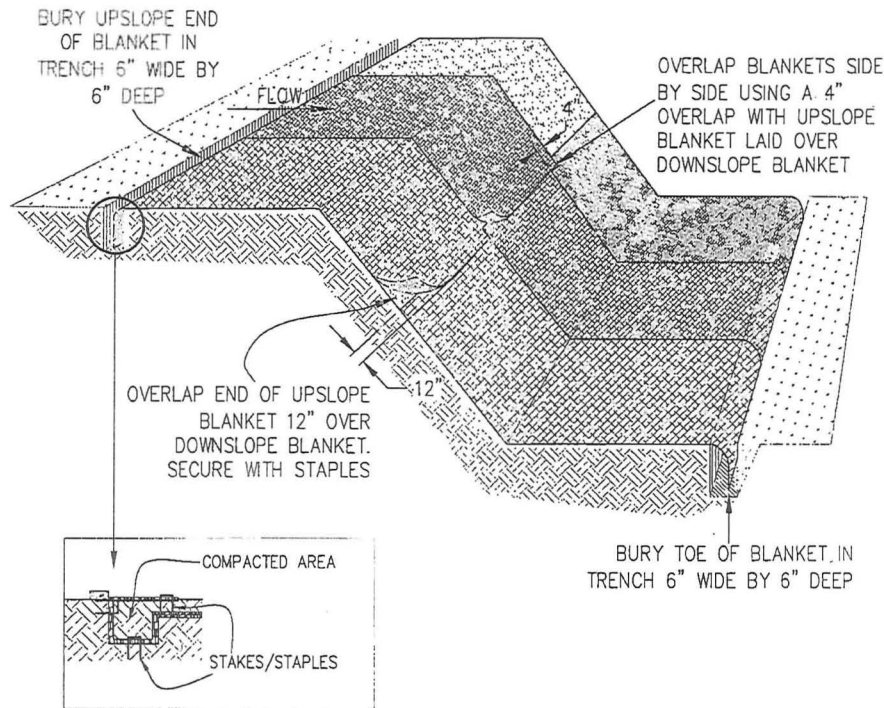
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MULCH BLANKETS



- NOTES:
- ① PLACE MULCH BLANKET PARALLEL TO FLOW AND ANCHOR SECURELY.
 - ② WHEN BLANKETS ARE USED IN FLOWING DITCH, BLANKETS SHOULD NOT OVERLAP IN DITCH CENTER PARALLEL TO FLOW.
 - ③ STAPLES INSTALLED/SECURED ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
 - ④ WHERE POSSIBLE, CONSTRUCT WITH BIODEGRADABLE MATERIAL.

MULCHING SPECIFICATIONS

1. Other surface runoff control measures should be installed prior to mulching.
2. Prepare surface to proper grade and compaction requirements.
3. If treatment area is to be revegetated immediately, spread or drill seed, or install vegetative sprigs into planting surface.

4. Select mulch material appropriate for site characteristics, including grade, level of traffic, installation method, and accessibility.

Straw – Most common and widely used material. Provides organic matter as it breaks down. Effectiveness of sediment reduction high for at least 3 months. Subject to windblow and washout. For straw, apply a minimum of 2 tons/acre or approx. 50 lbs./1000 sq.ft. to cover the surface. Increase application rates 50% for dormant seeding.

Rock – Crushed stone and gravel maintain effectiveness indefinitely if maintained to repair compaction. Cover 2–3" in depth (approx. 2.27 tons/1000 sq. ft.).

Wood chips/bark – Chips decompose slowly but may require nitrogen fertilizer application to avoid nutrient deficiency. Tend to wash down slopes over 6% and may clog inlet grates. Cover 2–3" in depth.

5. Mulches should not be applied if free surface water is present but may be applied to wet soil.

6. Mulches (particularly straw) may need anchoring. Common methods include crimping, disking, or punching into soil; covering with netting; spraying with a binder/tackifier, or keeping moist.



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BLANKET MULCHING DETAILS
Storm Water Control & Storage
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